

REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

As correctly noted in the Office Action Summary, claims 1 and 3-29 were pending with claims 14-19 and 22-26 withdrawn from consideration. By the present response, claims 1, 3-6, 8-12, 21 and 28 have been amended, claims 14-19 and 22-26 canceled, and claims 29-33 have been added. Thus, upon entry of the present response, claims 1, 3-13, 20-21 and 27-33 remain pending and await further consideration on the merits.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims, Figure 3, and the specification, page 4, lines 13-14, page 5, lines 17-23, page 6, lines 3,10-14 and 18-26, page 7, line 17 et seq., page 9, lines 5-10, page 10, lines 20-31, page 13, lines 26-28 and example 2.

Entry of the foregoing is appropriate pursuant to 37 C.F.R. §1.116 for at least the following reasons. First, the amendments raise no new issues that would necessitate further search and/or substantive reexamination. Second, the amendments clearly overcome the grounds of rejection.

EXAMINER INTERVIEW

Applicant appreciated the opportunity to personally interview the Examiner. The interview was helpful in addressing the outstanding issues in the application.

CLAIM REJECTIONS UNDER 35 U.S.C. §112

Claims 1, 3-13, 20, 21, and 27-29 stand rejected under 35 U.S.C. §112, first and second paragraphs on the grounds set forth in paragraphs 1-3 of the Official Action.

By the present response, Applicant has amended claims 1, 5, 10, 11, 12 and 29 in a manner which addresses the above-noted rejection and consistent with the discussion with the Examiner in the personal interview dated January 14, 2004. Reconsideration and withdrawal of the rejection is respectfully requested.

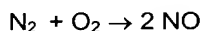
CLAIM REJECTIONS UNDER 35 U.S.C. §102

Claims 1, 5, and 8-9 stand rejected under 35 U.S.C. §102(b) as being clearly anticipated by WO 00/21647 (hereafter "WO '647") on the grounds set forth in paragraph 5 of the Official Action. This rejection should be withdrawn because the noted reference does not contain each and every element of Applicant's claim and therefore is not a proper anticipation rejection.

The presently claimed system for purifying a flow of exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, and in which a mixing ratio of the engine is periodically adjusted from a lean mixing ratio to a more stoichiometric or rich mixing ratio with a λ value below 1.2, the system comprises a combination of three operational units. The combination of three operational units includes a NO_x adsorption catalyst; an oxidation catalyst effective to promote oxidation of at least NO to NO₂; and a particle separator. In a flow direction of the exhaust gas, the NO_x adsorption catalyst is arranged before said oxidation catalyst or the NO_x adsorption catalyst is arranged in the same structure with the

oxidation catalyst of the three operational units, whereby the system reduces the amounts of hydrocarbons, carbon monoxide, nitrogen oxides and particles present in the exhaust gas.

Generally, harmful NO_x is usually formed in the reaction between nitrogen and oxygen thermally at high temperature (>1000°C):

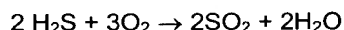


It is generally not preferred that this nitrogen oxidation happens on the catalyst and it is not a usual catalytic reaction.

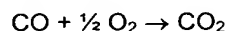
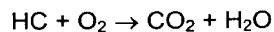
Formed NO is generally oxidized on an oxidation catalyst to form NO₂, the formation of which is desirable for particle filter regeneration. In addition, the typical gas purification includes a subsequent NO_x adsorption:



In contrast to the general systems discussed above, in the presently disclosed system the oxidation catalyst is positioned after the NO_x adsorption catalyst or at the same structure therewith (contrary to the prior art location). In such case, the oxidation catalyst can additionally remove odorous H₂S (see, e.g., p. 10, lines 20-31 of the specification):



Furthermore, the oxidation catalyst positioned after the NO_x adsorption catalyst or at the same structure therewith can also promote HC and CO removal in all conditions (see, e.g., p.4, lines 13-14, p. 6, line 3, p. 13, lines 26-28 of the specification, and original claim 9):



Therefore, the oxidizing catalyst of the present system can have several oxidative functions in addition to the oxidation of NO.

WO 647 discloses a 4 unit combination comprising, in sequence, a 1st catalyst to oxidize NO to NO₂ (NO oxidation catalyst), a filter (PF) as a 2nd unit, a NO_x adsorber (NO_x trap) as a 3rd unit and a three-way catalyst (TWC) as a 4th unit.

As to the features of WO '647 referenced by the Examiner (e.g., WO '647, p. 4, lines 9-11), Applicant respectfully disagrees with the Examiner's application of this feature of WO '647 to the indicated feature of Applicant's claimed system.

First, it is respectfully noted that the disclosed "additional fourth catalyst" of WO '647 is not part of the combination of the three operational units. The "fourth catalyst" proposed in WO '647 is generally associated by one of ordinary skill in the art with a separate catalyst bed, after the NO_x adsorbent, and is typically composed of a three-way catalyst (TWC) comprising, e.g., Pt, Pd, and/or Rh (platinum group metals, PGMs). Thus, the three-way catalyst in the system of WO '647 is not used for, and is not suitable for, oxidation of NO to NO₂ (in contrast to the oxidation catalyst used in Applicant's claimed system).

Furthermore, the feature (30) of WO '647 is used for improving the "enrichment" regeneration method of the system of WO '647: According to p. 2, lines 9-10, the fourth catalyst is used under three-way conditions (= under rich or stoichiometric conditions) for converting HC and CO to H₂O and CO₂ and for reducing NO_x to N₂.

The fourth catalyst of WO '647 may be associated with the adsorbent (p 4, lines 13-16) or be in a separate bed. It is composed of PGMs like Pt, Pd and/or Rh (a typical TWC composition). TWC and SCR-type catalyst are mentioned in WO

'647 for the fourth catalyst (p. 4, lines 5-11). However, WO '647 does not appear to mention oxidation catalysts. Further, the NO_x trap usually does not contain PGM, but PGM and TWC catalyst compositions are separate in the 4th unit.

There are several claimed features that distinguish the present claims over the cited document.

First, the presently claimed system is a 3-unit combination with a specific placement of the oxidation catalyst. In contrast, WO '647 discloses a 4-unit combination with a specific order of features.

Second, the presently claimed system proposes to use PGMs in the NO_x adsorption catalyst (original claim 13). In contrast, WO '647 is proposing the separation of absorbents and PGM metals.

Usually NO_x trap catalysts are composed of both adsorption materials and PGM metals. However, WO '647 shows a very different system which is also very different to Applicant's claimed system. WO '647 discloses the differentiation of NO_x adsorption materials and active PGM catalysts (3rd and 4th units) which are usually known by one of ordinary skill in the art to be integrated. WO '647 also discloses the separation of NO₂ formation and NO_x adsorption, but Applicant's claimed system combines these properties in the same operational unit.

Third, WO '647 does not disclose, teach or suggest positioning an NO oxidation catalyst after a NO₂ absorber. In the present application, the NO oxidation catalyst of the three unit system is different from the TWC in the WO '647 disclosed system.

For at least the above noted reasons, the presently claimed system for purifying a flow of exhaust gas is not anticipated by the disclosure in WO '647 and

the anticipatory rejection over claim 1 is improper and should be withdrawn. The rejection of dependent claims 5 and 8-9 are also improper for the same reasons and should be withdrawn.

In addition to the above, the following reasons also apply to distinguish the presently claimed system over the disclosure in *WO '647*.

(a) In *WO '647*, NO_2 is always formed before the NO_x adsorption catalyst. In the presently claimed system, NO_x adsorption catalyst is always after or at the same position as all the oxidation catalysts. So, *WO '647* always has oxidation catalyst (to NO_2 formation) before NO_x absorber.

(b) The system disclosed in *WO '647* does not contain in base form any PGM metals, whereas in the present system PGM can be included, i.e., as a further embodiment of the invention PGM metals and adsorption materials may be integrated (see, original claim 13).

(c) The presently claimed system is not limited in function to only a NO oxidation catalyst (or nitrogen oxidation catalyst) as is the system disclosed in *WO '647*.

(d) The fourth catalyst disclosed in *WO '647* is a TWC or SCR-type. There is no disclosure or suggestion in *WO '647* that the fourth catalyst is an oxidation catalyst. Although, TWC catalyst can oxidize HC and CO, NO is simultaneously reduced in TWC reactions (p. 2).

(e) The difference between the four unit system in *WO '647* and the three unit system in the present application can further be supported by the described uses of each system. *WO '647* regenerates NO_x absorbent by fuel introduction not by A/F ratio control as disclosed in the present application. Further, the present application

does not use only fuel introduction because it is too expensive. Rather, the present application used a small amount of fuel as additional reductant to enrich our lean gas mixture.

For example, additional fuel injection would require the addition of 15,550 ppm propene to convert the mixture to rich. This means huge additional fuel consumption and will ruin the fuel economy of the engine. In contrast, the Applicant's system uses only 1/10 of that HC amount, e.g., 1000-3330 ppm propene to simulate the exhaust gas to enrich the gas mixture (Table 1).

(f) WO '647 clearly discloses in claim 1 that the fourth unit (and all four units) of the system are in line and "vi. at least during said regeneration, subjecting the gas leaving the absorbent to a catalyst system effective to promote reactions of HC and CO with O₂ to H₂O and CO₂ and to react NO_x to N₂." In other words, WO '647 discloses a three-way catalyst.

(g) The presently claimed oxidation catalyst is a catalyst operating in lean conditions. The NO_x performance of oxidation catalyst is very low (<15% deNO_x). See, Figure 5. Further, one of ordinary skill in the art would understand a diesel catalyst to be a lean oxidation catalyst (as is disclosed on page 13 in lines 23-25 where it is described that the "Used oxidation catalyst was an oxidation catalyst developed for diesel conditions... the catalyst thus being highly active relative to both the oxidation of CO/HC and the NO₂ formation from NO.").

In addition, the present application discloses that a "Small amount of nitrogen oxides were also reduced in diesel conditions between temperatures 150 and 280°C at this Pt-catalyst."

In contrast, NO₂ is not formed in the TWC disclosed in WO '647 because it is against natural laws like thermodynamic equilibrium.

For at least these additional reasons, the presently claimed system distinguishes over the cited reference. In addition, each and every feature of Applicant's rejected claims is not disclosed in the cited reference. Withdrawal of the anticipatory rejections is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 3-4 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO '647 on the grounds set forth in paragraph 6 of the Official Action.

Claims 6-7, 10, 13, and 21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO '647 in view of U.S. Patent No. 4,887,427 to Shinzawa et al. (hereafter "*Shinzawa et al.*") or DE 3,518,756 (hereafter "*DE '756*") on the grounds set forth in paragraph 9 of the Official Action.

Claims 11-12 and 20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over WO '647 in view of *Shinzawa et al.* or *DE '756* as applied to claim 10 above and further in view of EP 758,713 (hereafter "*EP '713*") on the grounds set forth in paragraph 10 of the Official Action.

Each of these claims depends from independent claim 1. Further, the cited documents do not contribute to the overcoming the deficiencies noted with respect to the primary reference WO '647 as discussed above for the 35 U.S.C. §102 rejection. Accordingly, for at least the same reasons as previously discussed, these rejections should be withdrawn.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

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